the remaining twenty-two being recognized as varieties, or in some instances as mere seasonal or habitat forms. Two types of contemporaneous males are described for *B. brevirostris*, and are also stated to occur in *B. lilljeborgii*. One of the two exhibits a marked resemblance to the female in its secondary sexual characters, — armature of the post-abdomen and structure of the antennæ. The author suggests that this dimorphism may be serial in the life history of the male, representing two stages separated by a molt.

Although the lake is a small one, it presents a number of well-marked faunal areas, determined largely by the nature of the substratum and of the vegetation. Full lists are given of the characteristic faunas, and the adaptations exhibited by their constituent organisms are discussed at length. We note that no mention is made of the pelagic habit of many Rhizopoda, and that the author ranks Dinobryon, Hyalodaphnia, and Diaphanosoma as tycholimnetic organisms — forms which in most bodies of water are typical planktonts. Attention is called to the uneven distribution of the Cladocera occasioned by the influence of light. At night they are dispersed through the water, on cloudy days they congregate in the upper strata, but on bright days they gather in great swarms on the sunny side of clumps of Scirpus, shifting their position as the day advances. The Copepoda and Ostracoda, on the other hand, appear to be indifferent to the influences of light to which the Cladocera show so marked a response.

CHARLES A. KOFOID.

UNIVERSITY OF ILLINOIS, URBANA, ILL.

The Embryonic Development of the Wall-Bee (Chalicodoma muraria Fabr.)[1] — Prof. Justus Carrière's untimely death in 1894 left his valuable study of the embryology of the wall-bee incomplete. The notes and preparations of the Strasburg savant have been saved from oblivion by Dr. Otto Bürger, of Goettingen, and published in a fine quarto with thirteen excellent plates. The first part of the work, dealing with the formation of the germ-layers, is wholly the work of Carrière ; the second part, by Bürger, is based on Carrière's preparations, notes, and sketches.

The work is of peculiar interest as the latest and most complete account of the embryonic development of a hymenopterous insect.

[1] Die Entwickelungsgeschichte der Mauerbiene (Chalicodoma muraria Fabr.) im Ei, v. Dr. Justus Carrière, herausgegeben und vollendet v. Dr. Otto Bürger. *Nova Acta, Abh. d. kaisl. Leop.-Carol. Akad. d. Naturforscher*, Bd. lxix (1897), Nr. 2, pp. 255–419, Taf. XIII–XXV.

Up to the present time the papers of Grassi (1884) and Bütschli (1870) on the development of the honeybee, contained nearly all our knowledge of hymenopterous embryology. The Hymenoptera are interesting as a highly specialized insect type, and the observations contained in Carrière's and Bürger's monograph are valuable because they enable us to appreciate more fully the peculiarities in the development of the more generalized insect orders (Apterygota, Dermaptera, Orthoptera, Odonata, Hemiptera, etc.). It also appears that certain problems, such as the origin of the germ layers, can be studied, as Carrière and Bürger show, to greater advantage in the bee than in any other insects hitherto investigated, because the embryo always remains on the ventral surface of the egg, and is never longer than the egg, *i.e.*, its posterior end neither curls over to the dorsal surface of the yolk as in Coleoptera, Diptera, etc., nor becomes imbedded in the yolk as in Hemiptera and certain Orthoptera. Other advantages of a technical character are the liquid yolk, which is easily sectioned, the thinness of the shell (chorion), and the large size of the egg. These advantages have enabled Carrière and Bürger to make an accurate study of the formation of the germ-layers. Their conclusions are essentially the same as those published by Heider and Wheeler in their studies of Coleoptera (*Hydrophilus* and *Doryphora*). The entoderm arises from two widely separated regions of the blastoderm, one at the anterior, the other at the posterior end of the blastodermic groove which gives rise to the mesoderm. The anterior entoderm rudiment sends back a pair of cellular, band-like prolongations under the mesoderm, while the posterior rudiment sends a similar pair forward. The prolongations of corresponding sides meet and then envelop the yolk by spreading dorsoventrally. During this process the mesoderm is constricted off from the blastoderm in the mid-ventral line, and the stomodæal and proctodæal invaginations form, respectively, over the anterior and posterior entoderm rudiments. The formation of the stomodæum and proctodæum is so closely associated with the origin of the two entoderm rudiments that one investigator, Heymons, has boldly denied the existence of an entodermal germ-layer in insects. Heymons derives the whole alimentary tract from the ectoderm (!). Bürger, however, very justly dissents from this view. He shows that the entoderm arises from the *undifferentiated* blastoderm, and that the stomodæal and proctodæal invaginations arise from the superficial layer of blastodermic cells, the only layer that can properly be called ectoderm.

There are many interesting new facts in the portion of the paper devoted to a description of the organs arising from the different germ-layers. Carrière discovered a pair of minute evanescent appendages on the first brain (protocerebral) segment, and another pair on the third brain (tritocerebral) segment. Bürger confirms the accounts of preceding writers who claim that the antennæ arise from the second brain (deutocerebral) segment. Three pairs of oral appendages and three pairs of thoracic appendages are formed as in other insects, the latter notwithstanding the fact that the bee has an apodal larva. The thoracic appendages, however, soon flatten out, and Bürger finds that their hypodermal cell-layer thickens and becomes the imaginal disks, which, in the larva, are the rudiments of the legs of the imaginal bee. This interesting observation should be brought to the notice of those investigators who regard the gonapophyses of insects as dyshomologous with ambulatory legs, for the reason that the gonapophyses develop from larval structures resembling imaginal disks (Heymons). Bürger claims that he was unable to find rudiments of abdominal appendages on more than the first to fourth segments. His figures 28 and 35, however, show them on all the abdominal segments as in many insects more primitive than the bee. The pairs on the eighth, ninth, and tenth segments are peculiarly distinct and are evidently the rudiments of the gonapophyses (ovipositor). Bürger nowhere mentions these structures.

Another valuable observation made by Bürger is the presence in the embryo of the imaginal disks of the wings. Weismann and Graber claimed to have found these in the embryos of the blowfly, but their accounts are far from being satisfactory. The wing-disks of the bee arise as a pair of hypodermal thickenings with subjacent accumulations of mesoderm cells lateral to the leg disks in the meso- and meta-thoracic segments. They are beautifully shown in Bürger's Fig. 173. The labrum arises as a pair of discrete appendages in front of the stomodæum. These ultimately fuse in the middle line.

The origin of the tracheæ, spinning glands, tentorium, and flexor mandibulæ are described in detail. The tentorium is formed from two pairs of ectodermal invaginations resembling tracheal pits in the mandibular and second maxillary segments. The flexores mandibularum arise from a similar pair of invaginations in the first maxillary segment. The spinning glands are derived from a pair of invaginations immediately behind the second maxillary segment. The Malpighian vessels arise, as Carrière has shown in an earlier paper,

before or during the invagination of the proctodæum, as two pairs of depressions in the ectoderm of the anal segment.

Bürger describes the formation of the midgut, or mesenteron, in detail. The vitellophags left in the yolk when the segmentation cells are migrating to the surface to form the blastoderm, in the later stages of development arrange themselves on the surface of the yolk as a continuous epithelium immediately inside the entoderm. This vitellophag layer, however, forms no portion of the definitive midgut wall, but disintegrates towards the close of embryonic life, just as the scattered vitellophags disintegrate in other insects.

Bürger's account of the nervous system of the Chalicodoma embryo is mainly valuable as a confirmation of the observations of Heider, Wheeler, and Viallanes on other insects. Carrière and Bürger regard the frontal ganglion as the first segment of the brain, and the labrum as its pair of appendages. Their interpretation of the remaining head segments is the same as that of the above-mentioned authors. The ventral nerve chord is derived from neuroblasts similar to those found by Wheeler in Doryphora. The ganglionic cells budded off from the neuroblasts are not in regular rows as in the Orthoptera (Xiphidium, *e.g.*). The account of the origin of the Mittelstrang is unsatisfactory. Bürger agrees with preceding writers in deriving the ganglia of the sympathetic nervous system from the dorsal wall of the stomodæum. The "ganglia allata" which Heymons discovered in Forficula arising from a pair of invaginations near the base of the maxillæ and subsequently moving around and uniting on the dorsal surface of the stomodæum, are probably not ganglia at all, if certain large structures found by Bürger in corresponding positions in the bee should prove to be homologous with the bodies observed by Heymons.

The development of the body-cavity (schizocœle) is traced by Bürger, together with the portions of the walls of the cœlomic sacs that give rise to the heart, pericardial septum, pericardial fat-body, the main mass of the corpus adiposum, the ventral and dorso-ventral musculature. The heart is formed from two rows of cells (cardioblasts), which move towards each other around the yolk and finally unite to form a tube in the mid-dorsal line. The deutocerebral is the only head segment that contains a pair of mesoblastic somites with distinct cœlomic cavities.

Carrière finds the first traces of the reproductive organs in embryos with the full number of segments and the appendages beginning to bud out. They appear as large cells in the walls of the mesoblastic

somites of the third, fourth, and fifth abdominal segments. These cells, which seem to be restricted to the dorsal wall of their respective somites, subsequently collect about a common center to form on either side a small oval body, — the ovary or testis. The vasa deferentia and oviducts arise from the mesoderm. The former terminate in the tenth, the latter in the seventh abdominal segment, in both cases in terminal ampullæ as described by Wheeler for Xiphidium. A thickening of the hypodermis over the terminal ampullæ represents the rudiment of the ectodermal portions of the reproductive organs (ductus ejaculatorius and vagina).

The embryonic envelopes of the Hymenoptera promise to yield interesting results when carefully investigated. In the Phytophaga the envelopes are complete and typical, as shown by Graber in *Hylotoma berberidis*. In the other Hymenoptera hitherto studied only one envelope, the amnion, is formed. Carrière shows that it arises in the wall-bee from the peripheral portion of the blastoderm and persists only a short time. The exact mode of its obliteration is not clearly figured or described. By the time of hatching it has almost completely disappeared. Bürger claims that embryos of *Polistes gallica*, at least in the later stages, agree with Chalicodoma in possessing only a single embryonic envelope, and that this also disappears before the hatching of the larva.

WILLIAM MORTON WHEELER.

Tumors and Germ-Layers. — Since tissue differentiation in organisms has come to occupy so large a place in the attention of biologists, the general subject of tumors has assumed a biological interest that is but little less than its medical interest.

A recent paper by Dr. D. Montgomery, with a note by Dr. L. F. Barker,[1] dealing with a case of teratoma, contains so much of interest that it deserves to be more widely known to biologists than it is likely to become through the pages of a medical journal. The tumor was taken from the peritoneal cavity of a girl twelve years old. It was of the solid variety, *i.e.*, it was not a single large cyst, but was a mass of tissue with a great number of small cysts scattered throughout its substance. Its weight was two pounds. It was situated on the right side of the abdomen, and was attached to the ascending

[1] A Teratoma of the Abdominal Cavity, by Dougless W. Montgomery, M.D., with a Note on Dr. D. W. Montgomery's Case of Teratoma, by Lewellys F. Barker, M.D. *The Journ. of Experimental Medicine*, vol. iii (May, 1898), No. 3, pp. 259–292.